

## THE RESPIRATORY SYSTEM

The respiratory system is divided into upper and lower respiratory tract.

### UPPER RESPIRATORY TRACT

**Nose:** The nose is the natural pathway for air to enter the body in the process of breathing.

Functions of the nose include...

- Temperature regulation: warming and moistening air as it enters the body.
- Filtrating dust particles by trapping them in the stiff hairs that line the nostrils.
- The nares and septum are covered with a soft delicate mucous membrane.
- Sense of smell: the back of the nares are two cavities called *nasal fossae*. The top of these fossae possesses tiny receptors derived from the olfactory nerve. When we have a cold, these receptors get covered in thick mucus, causing us to lose our sense of smell and sometimes taste.
- Sinuses are spaces found in the front of the skull that connect to the inside of the nose. They are located behind the eyebrows and cheeks, creating a triangular formation between the eyes and nose. Sinuses also function cushion the impact of blows to the face
- Tear ducts carry tears away from the eyes. These ducts are also connected to the nose, often causing individuals to blow their nose when they cry.

**Throat:** The throat is subdivided into three areas, the pharynx, larynx and trachea.

*Pharynx:* Is located at the back of the mouth, extending downward to the inside of the neck. The pharynx is lined with muscles and extends about 5" behind the arch at the back of the mouth to meet with the esophagus junction. The outermost tissue layer contains mucous which acts to keep the mouth and throat well lubricated when eating and speaking.

*Larynx:* Is the body's voice box, which consists of vocal cords. These cords produce sound and speech when vibrating. The larynx is found in the centre of the neck, at the top of the trachea. Overlapping the larynx is the epiglottis, which is a flap valve that acts to cover the opening from the back of the throat into the larynx, also known as the glottis.

*Trachea:* Is found at the front of the throat, consisting of cartilage hoops that act to hold the elastic tissue open. It is approximately 4" long and 1" in diameter. The top of the trachea is covered by a thyroid cartilage or Adam's apple. It is lined with a mucous membrane that contains cilia that functions to push dust and germs into the throat to be swallowed. The trachea then connects to the bronchi.

## LOWER RESPIRATORY TRACT

The lower respiratory tract consists of the bronchi, diaphragm and lungs.

There are two bronchi found in the body, the right bronchi being shorter and more vertical than the left. Inside the lung, they branch into the secondary and tertiary bronchi. From there, they divide further into the bronchioles, which end at the alveoli; also known as the air sacs.

Beside the bronchi and entering into the lungs, is a system of interknit tubes formed by the pulmonary arteries. These branch into blood vessels located beside the bronchioles and, then again, into capillaries beside the alveoli.

**Diaphragm:** The diaphragm is a muscular wall that contracts and relaxes, resulting in atmospheric pressure change within the lungs.

- When the pressure increases, air rushes out, leading to expiration.
- When the pressure decrease, air rushes in, resulting in an inspiration

**Lungs:** The lungs are a grayish-mauve color and have a spongy appearance.

The right lung has 3 lobes, while the left lung has only 2 lobes. This is due to the extra space required by the heart. Humans take an average of 18-20 respirations per minute. If the lungs were removed from the chest, they would shrink like deflated balloons.

- **Pleura:** The pleural membrane that covers the lungs consists of two layers. The visceral or inner layer lines the outside of the lung, while the parietal or outer layer lines the inside of the thorax. Between these two layers is the pleural cavity. These two layers meet at the hilum of the lung where it connects to the trachea by the bronchus. In healthy individuals, these two layers are always in contact with each other and slide easily over each other during respiration. The pleura cavity can feel pain, but the lung itself cannot. The tidal air is the air that is inhaled and exhaled during normal quiet breathing. Residual air is the air remaining in the lungs that cannot be forced out.
- **Breathing:** As we breathe, most of the work comes from the diaphragm; contracting and relaxing. When air is drawn into the lungs, it travels to the alveoli where the oxygen and carbon dioxide exchange occur. Oxygen is then absorbed by the hemoglobin in the blood. Red blood cells returning from the extremities of the body/organs (which have just been oxygenated) now carry carbon dioxide, which exits the body through the alveoli during an exhale.

## **DISEASES OF THE RESPIRATORY SYSTEM**

**Asthma:** A chronic disorder with recurrent attacks of wheezing and shortness of breath, usually involving the lungs, bronchi and bronchioles. Causes of asthma include stress, smoking, exercise, lung infections (i.e. bronchitis), and allergens such as dust, animal dander, moulds and food.

- Symptoms include, chest tightness, shortness of breath, wheezing upon exhalation, coughing (especially at night), breathing difficulties, tightening of the neck muscles and exhaustion.

**Bronchitis:** Inflammation of the air passages of the lungs, involving the trachea, bronchi and bronchioles. It is caused by an infection often beginning with a cold or inflammation from irritants such as dust or smoke.

- Symptoms include cough with little or no sputum, burning chest discomfort or feelings of pressure under the sternum, and wheezing or uncomfortable breathing.

**Cancer of the Lung:** Also called bronchogenic carcinoma, cancer of the lungs results from the growth of malignant tissue in the lungs, spreading into the bronchial tubes and even the larynx. It is often caused by cigarette smoking, air pollution, or secondary cancer.

- Symptoms are intense, persistent cough, sputum with blood, wheezing, chest pain, fatigue, weakness and weight loss.

**Emphysema:** Is a chronic lung condition in which the alveoli become overstretched, thus, destroying the elasticity of the fibres that open and close during breathing causing some to rupture. It is likely caused by years of smoking, exposure to air pollution, inflammation and/or an inherited trypsin deficiency.

- Symptoms are shortness of breath, wheezing and coughing with scant sputum, as well as recurrent infections to the lungs and bronchi.
- The chest becomes barrel-shaped, the fingers clubbed and the nails blue.
- It takes an extreme effort for a person with emphysema to blow out a candle, if they can at all.

**Laryngitis:** A minor inflammation of the larynx and surrounding tissues causing hoarseness. It is caused by viruses, bacteria, allergies, excessive use of the voice, electrolyte imbalance of potassium and stress.

**Pleurisy:** The inflammation and irritation of the pleura caused by infections, partial lung collapse, blood clot in the lung, injury to the chest (i.e. rib fracture), cancer, congestive heart or kidney failure and liver disorders.

- Symptoms include sudden chest pain worsening with breathing and coughing, fever, discomfort over the affected side, rapid shallow breathing.

**Pneumonia:** An infection and inflammation of the lungs and bronchial tubes caused by bacteria such as streptococcus or staphylococcus.

-Symptoms are high fever, shortness of breath, cough with sputum with blood streaks, rapid breathing, chest pain that worsens with inhalation, abdominal pain and fatigue.

**Tuberculosis:** Is an acute or chronic contagious bacterial infection caused by the germ mycobacterium tuberculosis, which is transmitted in the air from one person to the other.

- Symptoms include weight loss, chronic fatigue, heavy night sweats, bloody cough, yellow or gray thick sputum, chest pain, shortness of breath, and reddish or cloudy urine.

## THE SKIN

The skin does not fit primarily into a specific system; therefore, we will discuss it independently for the purpose of this course.

The skin has 3 major functions including...

1. **Protection:** Acting to cover and waterproof the body, so we do not dry up in the heat or melt in the rain. It also protects us from sunlight radiation.
2. **Temperature regulation:** Functioning to heat and cool the body as needed. It keeps our body temperature constant at 37.2 degrees Celsius or 98.6 Fahrenheit.
3. **Sensory:** The skin also gives us sensory perception over the entire body.

### **LAYERS OF THE SKIN**

The skin consists of two components. The outermost part is called the epidermis and the innermost layer called the dermis.

**Epidermis:** The epidermis consists of several layers of cells. Here, the cells move up, flatten at the surface and die; forming keratin, which is shed as tiny visible flakes of skin. It takes 3-4 weeks for these skin cells to reach the surface.

**Dermis:** The epidermis is firmly attached to the underlying layer (dermis), which is made up of bundles of collagen and elastin fibres. Embedded in this layer are hair follicles, sweat glands, sebaceous gland, apocrine gland, blood vessels and nerves.

**Sweat Glands:** Each sweat gland is formed as a coiled tube of epidermal cells, which lead to a sweat duct and open on the skin's surface. Sweat glands secrete by emotion, as well as the body's need to cool down. These glands are controlled by the nervous system.

**Sebaceous glands:** Glands that open into the hair follicles. These consist of specialized epidermal cells that produce sebum or grease. They are found on the head, face, chest and back. Sebaceous glands lubricate the hair shaft & skin around it and are controlled by sex hormones.

**Apocrine glands:** Develop at puberty and can be found in the armpits, genital area and breasts. They produce an odour and are a sexual characteristic.

## **ADDITIONAL COMPONENTS OF THE SKIN**

**Skin color:** Results from a pigment called melanin. Melanin is found in the iris of the eye, as well as hair. In the basal area of the epidermis, there are the melanin-producing cells called melanocytes. Regardless of race, all humans have the same number of melanocytes. The amount of melanin that is produced depends on the surrounding environment. Dark skinned individuals produce more melanin because its function is to protect the skin from the harmful rays of the sun. The darker the skin, the less chance of sunburn. During tanning, melanin is formed, expanding the cells. The melanin then moves over to the cell centre covering it with a thin cloud, protecting it as the skin tans. The state of the blood found within the blood vessels of the skin can alter colour. For example, red with rage, blue when cold and white with fear.

**Hair:** Is formed by cells in the hair follicles. There are 2 types of hair. One is fine and downy. It is found all over the body, except the palms of the hands and the soles of the feet. The other form of hair is thick pigmented hair that is found on the scalp, eyebrows, genital areas and beard. The visible part of the hair is the shaft. The shaft develops from a root at the bottom of the follicle, which is nourished by the blood stream below. If the root is damaged, hair growth stops and may never regrow. The type of hair shaft determines straight or curly hair. A cylindrical shaft produces curly or wavy hair, while a flattened or kidney-shaped shaft produces woolly hair. Scalp hair grows about  $\frac{1}{2}$ " per month. Every 5-6 months, the hair goes into a resting phase.

**Nails:** Are produced by living skin cells, but the nail itself is dead and does not bleed or hurt when injured. The bottom part of the nail is implanted in a groove in the skin, which is called the root. The nail has several layers of skin, the lowest is known as the matrix. The cells of the matrix divide and the top ones become thick and tough with keratin. If the matrix is seriously damaged, the whole nail is lost.

## THE REPRODUCTIVE SYSTEM

The reproductive organs of the male and female are divided into internal and external genitals.

### **Female**

The external organs are the clitoris and labia which together are called the vulva.

**Vulva:** among the parts of the vulva are two pairs of lips called *labia*.

-The outer and larger, known as the *labia majora*, consists of thick folds of skin that cover and protect the area. They become thinner at the base and merge with the perineum. At the top they merge with the skin and hair on a pad of fatty tissue covering the pubic bone called the mons veneris, also known as the Mount of Venus.

-Inside the labia majora is the smaller or lesser lips, called the *labia minora*. They join at the top forming a protective hood over the clitoris. The area between these lesser lips is the nestible. This space is covered by the hymen or maidenhead. The hymen varies in shape, size and toughness. At the back, the labia minora joins together to form the couchette, which ruptures in childbirth.

**Clitoris:** is an organ of sexual excitement.

- It is sensitive and fills with blood when stimulated. Friction on this erect clitoris eventually leads to orgasm. The labia also contains erectile tissue and often enlarges in excitement with the Bartholin glands becoming active exuding a fluid to make the vagina moist for penetration. The skene's glands are just below the clitoris and secrete an alkaline fluid to make the environment, which is normally acidic, more friendly for the entrance of the sperm through penetration and ejaculation.

The internal organs include the vagina, uterus and ovaries.

**Vagina:** A canal about 3" long consisting of fibrous and muscular tissue around it.

- The urethra lies on the front wall of the vagina and the rectum lies at the back of the vagina.

**Uterus:** Is pear-shaped and about 3" long by 2" wide. The uterus is capable of great expansion during pregnancy. The uterus has 3 parts - 1. The fundus – upper end 2. The body or corpus 3.

**Ovaries:** Are two almond-shaped bodies found in the pelvis area lying on each side of the uterus.

- Above each ovary is a feathery finger-like opening of the fallopian tube which leads to the uterus.
- The ovaries contain masses of small sacs called follicles. Each follicle contains an ovum.

- Ovaries produce these follicles as one function and produce the hormone estrogen secreted by the follicles and progesterone secreted by the corpus luteum.

**Menstruation:** Is the time from the first day that one has a period to the first day of the next period. This is known as the menstrual cycle. After ovulation, the ovum travels to the uterus to wait to be fertilized by a sperm. When this ovum is not fertilized, the preparatory lining is shed in the menstrual flow. This allows a new lining to grow in preparation for the next ovum.

- The hypothalamus controls this cycle, which stimulates the pituitary gland to release several hormones for growth and maturation of several eggs, while another stimulates the release of these eggs.
- Mature eggs are surrounded by hormone-producing cells. The cells and the hormone produced together are called the Graafian follicle. The main hormone produced by the Graafian follicle is estrogen.

**Reproduction:** Is the union of a sperm and an egg. It takes the sperm approximately 45 minutes to reach the egg or ovum in the fallopian tubes.

- The fertilized egg travels down to the uterus and starts to grow tiny projections to help it burrow into the lining of the uterus. The egg is nourished by a rich blood supply in the uterine lining.
- The placenta forms from part of the fertilized egg that is embedded in the uterine lining.
- By 12 weeks, the placenta is a separate organ and supplies the developing fetus with food and oxygen. The placenta takes the waste products back to the mother.
- This system supplies the developing fetus until it is fully developed and birth occurs.

## **Male**

The male genitals consist of the penis and scrotum. They are located outside of the body, while the prostate gland and seminal vesicles are found inside the abdominal cavity.

The male reproductive system is designed to produce sperm and deposit it in the female.

**Penis:** Consists of a central tube called the urethra. The penis is used for urination as well as ejaculation. The penis hangs down in front of the scrotum, at a length varying from 3-5 ". When sexually stimulated and erect it is anywhere from 4-8" long. The tip of the penis, also known as the glans, is the most sensitive area.

- An erection occurs when the blood engorges the tissue areas of the penis and it rises due to the increased internal pressure. After ejaculation the blood flow diminishes to normal levels and the penis returns to its normal shape.

- Sperm is produced at the rate of 10-30 billion per month and can take up to 72 hours to mature. If there is no ejaculation the sperm disintegrate and are reabsorbed in the body.

**Bladder:** Is connected to the urethra and leaves through a hole at the tip of the penis called the meatus. Semen passes through the vas deferens and enters the urethra during intercourse. A tight muscle at the opening of the bladder holds the urine in until only urination is intended.

**Scrotum or testes:** Has a twofold purpose. This is where the sperm is produced, which contains cells that produce the male sex hormone testosterone. They have a structure called the epididymis, which collects sperm from the testes and connects together to form the vas deferens which takes on the sperm as it is released.

**Prostate:** A walnut-shaped gland found in the male that produces fluid that is mixed with the semen to make up part of the seminal fluid.

## **DISEASES OF THE REPRODUCTIVE SYSTEM**

### ***Female***

**Cervical Cancer:** A common but preventable form of cancer. The cause is unknown.

- Symptoms include unexplained vaginal bleeding, persistent vaginal discharge, pain and bleeding after intercourse, abdominal pain, appetite and weight loss, anemia and leaking of feces and urine through the vagina.

**Ectopic Pregnancy:** A pregnancy that develops outside the uterus, most commonly in the fallopian tube. Caused by a fertilized egg growing, stretching and rupturing within the fallopian tube, resulting in life threatening internal bleeding.

-Symptoms include unexplained vaginal spotting or bleeding, lower abdominal pain and cramping, pain in the shoulder

- In more dangerous stages...sudden, sharp, severe abdominal pain to rupture, dizziness, fainting and shock can occur.

**Endometriosis:** Is a disorder in which tissue resembling the inner lining of the uterus (endometrium) appears at an unusual location in the lower abdomen. Most commonly along the intestinal wall, on the ovaries, or behind the uterus. Caused by the backup of material used for fertilization in the uterus, leading up through the fallopian tubes into the pelvic cavity. Here, it floats freely and attaches itself to other tissues. It reacts each month as if it were still in the uterus, thickening and peeling away, spreading more and more.

-Symptoms include pelvic pain during menses, pain during intercourse, blood in urine and back pain.

**Fibroids of the Uterus:** Is an abnormal growth of cells in the muscular wall of the uterus. Cause is unknown; however, it may be hereditary.

-Symptoms include frequent menstruation, increased menstrual flow and discomfort, bleeding between periods, painful intercourse and bleeding after intercourse, increased vaginal discharge and feelings of pressure on the bladder or rectum.

**Ovarian Cyst:** Is a closed cavity or sac containing liquid or semi-solid material which develops in the ovary. Usually caused by a hormone disturbance.

-Symptoms include swelling without pain in the lower abdomen, painful intercourse, stinging or burning urination, difficulty emptying the bladder completely, brownish vaginal discharge and irregular menses.

-If the cyst breaks, severe abdominal pain, fever and vomiting may occur.

**PMS:** Symptoms that occur 7-14 days before a menstrual period and are stopped when it starts. Caused from fluctuations in the hormone levels.

-Symptoms include nervousness, dizziness, irritability, fainting, emotional instability, increased or decreased sex drive, headaches, tender swollen breasts, bloating, digestive disturbances, fluid retention and acne outbreaks.

**Vaginal Yeast Infection:** Infection or inflammation of the vagina caused by a yeast fungus (monilia or candida albicans). It tends to appear before menstrual periods because the PH balance of the vagina is disturbed.

-Symptoms are white "curdy" vaginal discharge.

-Odour may be unpleasant but not foul.

-Swollen, red, tender, itching of vaginal lips and burning on urination.

## **Male**

**Enlarged Prostate:** This is caused by hormonal changes that accompany aging and by diminishing sex life with few or no ejaculations.

-Symptoms include urinary urgency and frequency, burning sensation during urination, straining and dribbling during urination, occasional impotence and abnormal urine color.

**Sexual Impotence:** Is the inability to have or maintain an erection of the penis which is necessary for intercourse. Causes are about 80% psychological such as guilt feelings, poor relationships, depression and anxiety. Other causes are fatigue, diabetes, atherosclerosis, anti-hypertensive drugs, alcoholism, and drug use (especially marijuana, sedatives, tranquilizers and cocaine).

## THE DIGESTIVE SYSTEM

This whole system's function is to break down foods into absorbable substances that can be used by the body for energy, repair and growth. Our digestive system depends on enzymes that are produced by various digestive tract organs.

### THE PROCESS OF DIGESTION

The changes to the foods eaten begin in the mouth. During chewing or *mastication*, the salivary glands under the tongue secrete the enzyme ptyalin that begins breaking down some of the carbohydrates into smaller molecules; such as glucose and maltose.

Once food is swallowed, it then travels down the esophagus into the stomach where mucous, hydrochloric acid and the enzyme pepsin are produced. The amount of stomach juices is controlled in the stomach, in the intestine by nerve impulses and hormone secretion. The hormone gastrin allows the stomach to release hydrochloric acid and pepsin to break the food down into peptones. The mucous secretion coats and protects the stomach lining. The food leaves the stomach 3-6 hours after it has been reduced into a semi-solid consistency called *chyme*.

The food then enters the small intestine, also known as the duodenum. More mucus is then released to protect the intestinal lining from the chyme. Then, hormones cause the secretion of pancreatic juices. Bile is also released into the duodenum in order to break down food. See each specific enzyme below.

1. *Trypsin*: Breaks down the peptones of proteins.
2. *Lipase*: Breaks down the fat into glycerol and fatty acids.
3. *Amylase*: Breaks down carbohydrates into maltose.

The digested food then travels through the rest of the small intestine, with most food absorption taking place in the ileum. The remaining mass is wasted and works through the large intestine into the rectum, where it is expelled when there is enough accumulation.

### THE ORGANS OF DIGESTION

**The Mouth:** Is lined with a mucous membrane that contains glands that produce mucus, which keep the mouth moist. On the top of the roof of the mouth is a hard and soft palate, which helps to press and break down the food. Hanging down from the middle of the soft palate is a piece of tissue called the uvula or "3<sup>rd</sup> tonsil". Its function is basically unknown. The mouth has 4 functions including...

1. Chewing and breaking up food
2. Mixing food with saliva to lubricate it
3. To cool food or heat food
4. To swallow

**The Tongue:** Is triangular in shape. When eating, its main function is to transport the food to the teeth for chewing. It also molds the softened food into a ball or bolus to be swallowed. Its surface has 3 types of papillae:

1. *Filiform:* Dorsal aspect and sides
2. *Fungiform:* Located at the tongue's sides to sense sour, sweet and salty
3. *Vallate:* Is the V-shape at the back that tastes bitter

**The Teeth:** There are 32 permanent teeth in the mouth. They are 8 incisors, 4 canine, 8 premolars or bicuspid and 12 molars.

The tooth is made up of 3 parts:

1. *Crown:* Which is the visible part of the tooth that contains a protective coating of enamel over the dentine which covers the centre or pulp of the tooth. Here, blood vessels, lymph vessels and nerves are encased. Front teeth have one root, while molars have 2 or 3 roots.
2. *Neck:* Adheres the tooth to the gum.
3. *Root:* Penetrates the bone and anchors the tooth in place with ligaments made of fibers of collagen. The root is coated with a layer of cementum which also helps anchor the tooth in its socket.

**Salivary Glands:** Humans usually produce about 1.7 litres of saliva a day. There are 3 pairs of glands that produce saliva including the...

1. *Parotid Glands:* The largest glands, located in the neck just in front of the ear. These are the glands that when infected, are known as "mumps".
2. *Sublingual:* Located below the tongue.
3. *Submandibular:* Found below the mandible. The smallest of the salivary glands. They produce ptyalin which breaks down starch.

**Pharynx:** Has seven orifices.

1. Esophagus
2. Larynx
3. 2 openings to the nose
4. 2 openings to the ear
5. Mouth

**The Esophagus:** An elastic tube about 10" long and 1" in diameter. When the bolus enters it does not slide down the esophagus, but is actively pushed down by a series of wave-like contractions called *peristalsis*. There is no clear sphincter that separates the esophagus from the stomach. Usually the esophagus gets pinched off as swallowed material passes through the diaphragm on its way to the stomach. When this pinching is weak, a reflux will occur or even a hiatus hernia, which means some of the stomach acids may back up into the esophagus causing discomfort, indigestion and belching. This is commonly seen in pregnancy and old age.

**The Stomach:** Is a muscular bag connected to the esophagus at one end, and to the duodenum at the other end. The stomach can hold up to 1.5 litres of substance. The stomach has three coverings inside it:

1. The outer coating of the stomach is composed of serous membrane.
2. The middle coating is muscular.
3. The inner coating consists of a mucous membrane which is arranged in folds or rugae that disappear when the stomach is distended. This membrane also keeps the stomach from digesting itself.

There are 2 openings into the stomach:

1. At the top is the *cardiac sphincter* that prevents acid and food from backing up.
2. At the other end is the *pyloric sphincter* that releases the chyme in small amounts into the small intestine.

**Intestines:** When the partially liquefied digested food reaches the duodenum, it contains a lot of acid. It is neutralized here by bile and pancreatic juices. The *duodenum* is about 10" long and leads into the *jejunum* which is 8' long before it leads into the *ileum*, which is about 12' long.

The inner coating of the small intestine, particularly the jejunum, has a mucous membrane arranged in circular folds with the entire surface being made up of delicate finger-like projections called *villi*. Each villus has a central lymph channel or lacteal which absorbs the fat and drains it from the intestine which is called *chyle*.

The ileum is the lower part of the small intestine. Its interior is made up of muscular layers that are designed to move the remainder of the digested food forward into the large intestine or colon. There are groups of nodules found in the ileum called *Peyer's Patches* which fight infection.

The first part of the large intestine is called the *caecum*. It is guarded by the *ileocecal valve*, which prevents backflow of the intestinal contents. At the one corner of the caecum is the *vermiform appendix* – the actual function is unknown. The caecum bends at the *hepatic flexure* and goes forward into the transverse colon. Then, it bends sharply at the *splenic flexure* and proceeds down the *descending colon* to the *sigmoid colon* and the *rectum* and finally is expelled through the *anus*.

**The Liver:** The largest organ in the body, weighing 3-4 pounds and measuring 6-7 inches wide. It consists of 2 lobes. The right lobe is large and is subdivided into 3 sections. The left lobe has 2 sections. The liver is one of the few organs capable of repairing itself. The liver's functions include...

- The formation of *\*bile\** (up to 2 pints a day), which is then stored in the gall bladder.
- Processing of proteins, carbohydrates and fats to be used in the body.
- Vitamins such as A, B, E, and K are stored in the liver.
- Removes a yellow pigment called *bilirubin* from the blood.
- Lining the veins of the liver are *Kuepfer* cells that "vacuum" the blood of impurities such as bacteria.

**\*Bile:** A thick yellow or green, bitter fluid that is produced in the liver and stored in the gallbladder. Bile is released into the small intestine when food is present and needed to digest fats. It gets its colour from the pigment bilirubin.

When the liver is diseased or inflamed bilirubin tends to accumulate in the blood, which causes the skin and the white of the eyes to look yellow.

**Gallstones:** Form when hard lumps of cholesterol form inside the gallbladder. Some become large enough to actually block the bile duct.

**Pancreas:** A cream coloured gland resembling a fish in appearance, approximately 6-8 inches long by 1 ½ inches wide. It secretes enzymes and hormones including *insulin*, which are necessary for proper digestion to occur. Insulin is produced by cells, called the *Islets of Langerhans*, scattered all through the pancreas. Insulin regulates the utilization of glucose in the body. If the pancreas does not secrete insulin properly, diabetes mellitus occurs.

## THE NEUROLOGICAL SYSTEM

The neurological system, or nervous system, is probably the most complicated system in the body. It functions to coordinate and integrate all bodily activities.

The link to the world in which we live is through:

**-Receptors:** Which receive information

**-Nervous system:** Is to process and interpret information

**-Effectors:** To act on information

**Receptors:** Are nerve endings that respond to stimuli impinging on them. Receptors react adequately only to very specific information. For example, the specialized receptors for vision, hearing, taste, touch and smell respond appropriately only to visual, auditory, taste, touch and smell stimuli respectively.

The following information about receptors has been included for interest value. You are not required to know this information for the final examination.

Specialized receptors in humans are grouped into three types:

**-Exteroceptors** are specialized receptors located on or near the surface of the body to receive information from the external world. Examples are receptors for the special senses such as vision, hearing, taste, touch and smell.

**-Interceptors** are specialized receptors located inside the organism. They receive information about the internal environment of the body. Receptors in the viscera or internal organs supply information about sensations of pain, hunger, nausea, etc.

**-Proprioceptors** are specialized receptors located in muscles, tendons and joints. They give one continuous information about one's body position in space. For example, if you close your eyes and extend your arm vertically, you are aware of your arm's position solely because of "muscle information" you receive from proprioceptors.

**Effectors:** Are nerve endings found in the muscles, glands and organs that act to produce change. Muscles and glands are sent the appropriate messages and action takes place. The receptor-nervous system-effector circuit makes complex and fast decision making possible.

**Nerve Cells:** The central nervous system (CNS) works because of millions of interconnected nerve cells, called *neurons*, which enable communication throughout the body by the transmission of impulses. Neurons are the basic functional unit of the nervous system.

**Autonomic System:** This is the other division of the CNS, divided into 2 workable parts. The *parasympathetic* and the *sympathetic* system. Each part uses a different chemical transmitter

where the nerve fibre reaches its target organ. Each is built differently and has a different effect on the organ it serves.

The whole of the *Autonomic System* is controlled by an area of the brain called the hypothalamus. This receives information about any variations noted and adjusts the autonomic system to bring the body back to the correct balance.

### **DISEASES RELATING TO THE NERVOUS SYSTEM**

**Alzheimer's Disease:** A brain disorder characterized by gradual mental deterioration. In the early stages, forgetfulness of recent events, personality changes, difficulty doing simple tasks like choosing clothes to wear, etc will occur. Presently, there is no known cure.

**Bell's Palsy:** Is the paralysis on one side of the face with no known causes. It causes pain behind the ear on the affected side and distorted smiles/frowns.

**Epilepsy:** A disorder of the brain function characterized by sudden seizures and brief attacks of inappropriate behaviour. Common causes include brain damage at birth, drug or alcohol abuse, severe head injury and brain tumour.

**Huntington's Chorea:** A twitching that worsens with time. It is non-reversible and fatal. It is hereditary and occurs after age 30, lasting 15-20 years. The disease is caused by a defect on chromosome 4. The movements are very abnormal, behaviour becomes anti-social with dementia, moodiness and intellectual changes.

**Meningitis:** Caused by bacteria or viruses that reach the meninges via the blood or lymph and also through injury or from adjacent bony structures such as the sinuses or mastoid area. Symptoms include fever, loss of appetite, constipation, intense headache, intolerance to light, convulsions and even coma.

**Multiple Sclerosis:** A chronic disorder affecting many nervous system functions. Cause is unknown. Researchers suggest it may be caused by an auto-immune disorder or slow acting virus.

**Parkinson's:** A disease of the CNS in older adults, characterized by gradual progressive muscle rigidity, tremors and clumsiness. Unknown causes.

**Reye's Syndrome:** A disease in children and teens that involves the brain and other major organs. Unknown causes, but usually follows a viral infection. Symptoms can include confusion, lethargy, and double vision and hearing loss.

**Shingles:** A viral infection of the CNS. It is contagious to people who did not get the chickenpox. It is caused by the varicella-zoster virus, which also causes chicken pox. It may lie

dormant in the spinal cord until triggered by risk factors. Consists of painful red blisters anywhere on the body, occurring most often on the chest and only on one side of the body.

**Stroke:** C.V.A, which stands for cerebrovascular accident, is a sudden decrease in the blood supply to part of the brain damaging the area so it cannot function normally. There are many causes such as high blood pressure or hardening of the arteries which in turn causes a clot (thrombosis) which blocks an artery, an embolism (moving clot) travels to the brain, cerebral hemorrhage in which a blood vessel ruptures and bleeds into surrounding brain tissue, and lastly rupture of an aneurysm of a small artery to the brain.

**Subdural Hemorrhage:** Bleeding that causes blood to collect and clot beneath the outermost of the three membranes that cover the brain. There are 2 types – one is acute, which occurs after a severe injury. The other is chronic, which develops weeks after an injury. The injury may be so minor that the patient does not even remember it. Classic signs include recurrent headaches that worsen each day, drowsiness, dizziness, weakness or numbness on one's body.

**Tic Douloureux:** Also known as Trigeminal Neuralgia, is a nerve condition that causes brief, but often severe facial pain occasionally known to be caused by pressure on the nerve from adjacent blood vessels but, more often the cause is unknown. The risk increases with multiple sclerosis.

**Viral Encephalitis:** Is an acute inflammation in the brain caused by a contagious viral infection caused by other viruses such as measles, mumps, mononucleosis or viruses carried by mosquitoes or other insects. Other causes include poisoning, vaccine reactions and leukemia. In mild cases, there is a feeling of being generally ill with a fever. In severe cases, there is vomiting, headache, stiff neck, personality changes, seizures, speech impairment and drowsiness that progresses to a coma.

## THE CARDIO-VASCULAR SYSTEM

This system consists of the heart and a network of blood vessels.

### THE HEART

The heart is situated almost in the middle of the chest, with more of it being on the left side than on the right. It weighs anywhere from 9-12 ounces, depending on the sex of the individual, and beats about 72 beats per minute (ranging from 60-120bpm).

-The function of the heart is to pump blood into the arteries from the aorta. The blood is then pumped into the lungs to re-oxygenate the blood.

The heart is divided into 4 main chambers. Each chamber is a muscular bag with walls that act to contract and push the blood onward. The thickest walled chamber is the *left ventricle*, which has the largest amount of work to do. There are 2 atriums and 2 ventricles. The *left and right atrium* are in the upper part of the heart, while the 2 ventricles are in the lower part of the heart. The right and left sides are separated by a solid wall called the *septum*. The right-side pumps deoxygenated blood through to the lungs; this blood is very dark in colour. The left side of the heart pumps oxygenated blood from the lungs back into the system, which is a bright, rich red colour.

With each heartbeat, the 2 atria contract together and fill up the ventricles with blood, which in turn causes the ventricle to contract. The control of the contractions comes from the *sinoatrial node* found in the right atrium. The other node, called the *atrioventricular node*, delays the contracting impulse and passes it down through a bundle of fibres called the *Bundle of His*, which causes the ventricles to then contract.

The blood that leaves the heart is oxygenated and travels through the *arteries* around the body. Smaller arteries are known as *arterioles* and very fine vessels are known as *capillaries*. The latter 2 being more superficial arteries as they are deeper.

The blood that returns to the heart is deoxygenated and travels through the *veins*. The veins have valves that prevent the blood from backing up in the system. When these valves don't work, blood pools in certain areas, particularly in the legs. These become known as *varicose veins*.

### HOW THE HEART CIRCULATES THE BLOOD

The blood returns to the heart through a large vein called the *inferior vena cava*. It enters the right atrium, and with the sinoatrial node stimulation, the right atrium contracts, sending the blood into the right ventricle through the *tricuspid valve*. The right ventricle contracts by activation of the atria-ventricular node and the blood goes through the *pulmonic valve* into the *pulmonary trunk* to the lung to be re-oxygenated. From there, they enter the left atrium through the pulmonary veins through the *bicuspid valve* into the left ventricle. Then, through the aortic valve to the aorta to reoxygenate the organs of the body.

## GLOSSARY

**ABDOMEN** – The abdominal cavity which lies between the diaphragm and the pelvis and contains all the organs of digestion, the kidneys, liver and the pancreas. The front wall is a muscular sheet and the internal surface is lined by the peritoneal membrane. (Compare with cranium and thorax)

**ACETYLCHOLINE** – Chemical released from the nerve endings and which is the “transmitter” for the parasympathetic nerves. Among its functions, it causes muscles to contract and bronchial airways to constrict.

**ACTH** – Adrenocorticotrophic hormone. A pituitary hormone which stimulates corticosteroid production. ACTH may be given by injection.

**ADENOIDS** – Collections of lymph tissue (like the tonsils) found in the pharynx at the back of the nose. May swell up in children.

**ADIPOSE TISSUE** – A kind of connective tissue used for storing fat.

**ADRENAL GLANDS** – Two glands above the kidneys which are responsible for the production of cortisone from their outer layers (the cortex) and adrenalin from their inner core (the medulla).

**ADRENALIN** – The body’s hormone of “fight or flight”; stimulates heart, lungs and other tissues for actions. Produced by the adrenal medulla.

**ALBUMIN** – A simple protein, manufactured in the liver and found in the blood plasma. It is both a food source for the tissues and a supplier of osmotic pressure to keep the blood fluid within the walls of the blood vessels themselves.

**ALDOSTERONE** – A hormone produced by the adrenal cortex. It regulates excretion of salt by the kidneys, maintains a balance of salt and potassium and plays a role in the body’s use of carbohydrates.

**ALLERGY** – Adverse reaction – such as wheezing or rashes – to a foreign substance which triggers the immune system. Usually the substance allergen is inhaled or contacts the skin. Food allergy also occurs.

**ALVEOLI** – Tiny air sacs in the lungs which are surrounded by capillaries. It is here that the exchange of oxygen and carbon dioxide takes place.

**ANTIBODY** – A substance carried dissolved in the blood which attaches itself to invading organisms (or other foreign substances) so helping the body to defend itself against infection.

**AORTIC VALVE** – The valve which separates the aorta from the left ventricle. It allows blood to flow from the left ventricle to the aorta and then into the tissues.

**APOCRINE GLAND** – One of the sweat glands found in the armpits, groin and the areola of the breasts. These glands produce a thick milky substance and it is these glands upon which antiperspirant acts. (Compare eccrine gland)

**APPENDIX** – A narrow finger-shaped piece of intestine hanging from the cecum. It has no apparent use in the body (though it may have had in the past); it can become inflamed and then needs removal.

**AQUEOUS HUMOR** – a WATERY FLUID WHICH FILLS THE ANTERIOR CHAMBER OF THE EYE, BETWEEN THE CORNEA AND THE LENS.

**ARTERY** – Large blood vessels carrying oxygen-rich blood from the heart to the tissues (e.g. the aorta).

**ATP** – Adenosine Triphosphate. A high energy phosphate compound produced by cells to provide power for the chemical reactions on which the cell depends. This ATP is stored in the cells until needed when it is broken down by the burning of glucose.

**ATRIOVENTRICULAR NODE** – A node in the heart at the junction of the atria and the ventricles. Signals the ventricles not to contract. This is part of the process which maintains a normal heartbeat pattern. ((See Bundle of His and sinus-atrial node).

**ATRIUM** – The left and right atria are the two low pressure pumping chambers of the heart. They pump blood to their corresponding ventricle chambers.

**AUTONOMIC NERVOUS SYSTEM** – Part of the nervous system which controls automatic functions, such as heartbeat and sweating. It consists of the sympathetic and parasympathetic nervous systems. Each of these separate systems is controlled by a special chemical 'messenger' or hormone; and they work by performance (egg. One part controls inhaling, the other exhaling - together breathing).

**BACTERIA** – Small signal-celled organisms, some of which cause infection.

**BARTHOLIN'S duct** – The duct from which is released the secretions of Bartholin's gland, the purpose of which is to lubricate the vagina.

**BASAL GANGLIA** – Four masses of nerve cells deeply placed within the base of the brain.

**BASAL METABOLIC RATE** – A measure of the basic level of the body's metabolic (chemical) processes. The rate is raised by thyroid over-activity and lowered by thyroid under-activity.

**BICEPS** – The large flexor muscle at the front of the upper arm. Together with the triceps, it helps facilitate elbow and shoulder movement. (Note: the combination of biceps and triceps are what is known as 'antagonistic', that is their function by opposing one another).

**BILE** – Fluid produced by the liver that is stored in the gallbladder and enters the intestines through the bile duct.

**BLADDER** – Urine produced in the kidneys is collected in the bladder which is voluntarily emptied. It lies in the pelvis.

**BLOOD CLOTTING** – The vital mechanism whereby components of the blood solidify after any damage, so stopping bleeding.

**BLOOD PRESSURE**– The pressure at which blood is carried in the arterial system.

**BONE MARROW** – The soft red material in the center of certain bones. It is in this red marrow that red blood cells, some white blood cells and platelets are manufactured.

**BOWEL** - To the doctor, simply means another word for intestine. 'Opening the bowels' means passing feces.

**BRAIN STEM** - That area which links the brain with the spinal cord and comprises part of the hindbrain, all of the midbrain and part of the forebrain. It is here that all incoming stimuli are received and directed to the correct side of the brain for them to be analyzed and a response to be determined.

**BROCA'S AREA** - The area of the brain to which deciphered speech is transmitted and where a reply is formed. From here a 'message' is sent to the face, via the motor cortex, which also stimulates the muscles of lips, tongue, jaw and throat to produce speech (in reply).

**BRUNNER'S GLANDS** - Any of the small glands in the duodenum which secrete protective mucus and a powerful enzyme which breaks down protein.

**BUNDLE OF HIS** - A very slim bundle of cardiac muscle that passes from the right atrium to the right and left ventricles, conducting the impulse to contract. This is part of the process which maintains a normal heartbeat pattern. (See atrioventricular node and sino-atrial node).

**CALCANEUS** - A large bone that is part of the tarsus (instep). It is commonly called the 'heel' or 'heel bone'.

**CALCIUM** - A mineral which is essential to give the hardness to bone. It is also carried and dissolved in the blood, and it controls the way in which muscles contract.

**CAPILLARY** - The tiny blood vessels that connect the arterioles (the ends of the arteries) to the venules (the ends of the veins), and so allow the contents of the blood to be passed through to the tissues.

**CARBOHYDRATE** - One of the three basic food types. Carbohydrates are the sugars and starches (chemical combinations of sugars) found in cereals, bread, flour, potatoes.

**CARBON DIOXIDE** - Oxygen is extracted from the air by the lungs and used to burn up food for energy. The waste produced from this reaction is carbon dioxide which the lungs pass back into the air.

**CAROTID ARTERY** - The artery which divides into right and left branches and carries blood to the head, one branch to the face and scalp, the other directly to the brain.

**CARPALS** - The eight cube-like bones forming the 'hinge' at the wrist, between the bones of the forearms and the metacarpals of the hand itself.

**CARTILAGE** - Gristly material attached to the bone and making joint cavities. There are two free cartilages in the knee, which are easily damaged and which may need removal.

**CECUM** - The blind pouch from which the large intestine starts. The ileum, or last of the divisions of the small intestine, opens into the cecum. The appendix projects from it.

**CELL** - The basic unit of the human body and all living things. Each cell contains a nucleus and protoplasm – the essential building material: the cell divides to build up tissues.

**CEREBELLUM** - The part of the brain that is concerned with coordinating movement and maintaining equilibrium. It is situated at the back of the skull, beneath the cerebrum.

**CEREBRAL CORTEX** - The outer layer of the brain.

**CEREBROSPINAL FLUID** - Fluid that bathes and cushions the brain and spinal cord.

**CEREBRUM** - The most highly developed and largest part of the brain. It is divided down the middle into two parts, known as the cerebral hemispheres.

**CERVICAL SMEAR** - A method of scrapping a few cells from the neck of the uterus for examination. Used to detect cancer. Commonly known as a 'pap smear' (after Dr. Papanicolaou, the doctor from whose research the test was developed).

**CERVIX** - The neck of the uterus. The central channel in the cervix dilates (opens) during labor to allow the birth of the baby.

**CHOLESTEROL** - A fatty substance which is an essential part of the structure of cell walls. When present in the blood in excessive quantities, it is laid down in the walls of arteries causing atheroma.

**CHROMOSOME** - One of a number of tiny red-shaped bodies inside the cell nucleus that carry the genes - the hereditary determinants. There are 23 pairs of chromosomes plus an additional two sex-determining chromosomes.

**CILIA** - Minute hair like bodies within specialized cells (e.g. those cilia within the endolymph, or fluid, of the inner ear, which sense movement; or the cilia within the nose which trap dust particles).

CLAVICLE - The bone which joins the scapula (shoulder blade) and the sternum (breast bone). Commonly called the 'collarbone'.

CLITORIS - An extremely sensitive organ of the female genitals, consisting of a spongy erectile tissue and located at the juncture of the labia minora. Friction on the erect clitoris will usually lead to orgasm.

COAGULATION - The process whereby blood solidifies to form a clot.

COCCYX - The five small fused vertebrae at the base of the spinal column. Commonly called the 'tailbone', it is all the remains of the tail which has been lost through evolution.

COCHLEA - The snail-shaped portion of the inner ear, which is filled with endolymph and lined with cilia and through which sound waves are transmitted, via the cochlear nerve, to the brain where they are interpreted.

COLON - The large intestine, a tube stretching from the end of the small intestine through to the rectum.

CONCEPTION - The fertilization of the ovum (egg) by the sperm, leading to embryo formation.

CONJUNCTIVA - The mucous membrane which lines the eyelid and continues over part of the eyeball.

CONNECTIVE TISSUE – The basic 'cement and packaging' of the body, which holds the organs in place and fills spaces. Fibers of the protein collagen provide the strength and the protein elastin provides stretchiness.

CORNEA - The transparent 'front window' of the eye.

CORPUS LUTEUM - When the ovary releases an egg in the middle of the menstrual cycle the corpus luteum is left at the site of release. It produces the hormone progesterone.

CORPUSCLE - An old-fashioned word for a red or a white blood cell.

CORTISONE - Hormone produced by the cortex (the part around the inner core) of the adrenal gland. It is essential for life and controls the body's response to stress.

COSTAL - Of or relating to a rib or ribs. (E.g. Intercostal spaces are those between the ribs).

CRANIUM - The part of the skull which encloses the brain. (The cranial cavity is one of the three main body cavities: compare with abdomen and thorax).

CRYPTS OF LIEBERKUHN - Small projections within the duodenum which secrete digestive enzymes and alkaline juice to neutralize stomach acid.

DIABETES - Failure of the hormone insulin to keep the blood sugar down. Leads to thirst and weight loss. Can be controlled by insulin injections, or in some cases by diet and medication.

DIAPHRAGM - The sheet of muscle which forms a barrier between the contents of the chest and those of the abdomen.

DISK - Flat circular body, consisting of a tough outer layer and an inner gelatinous core. The disks lie between each of the thoracic and lumbar vertebrae, which they cushion. They expand and contract as the spine moves and can sometimes be jolted ('slip') out of place.

DNA (Deoxyribonucleic acid) - The basic genetic material which is passed from generation to generation on the chromosomes. DNA is found in cell nuclei and controls protein manufacture in the cell.

DUODENUM – The first 10in (25cm) of the small intestine as it leaves the stomach.

ECCRINE GLAND – One of the sweat glands found all over the body (except the lips and part of the sexual organs). These glands are controlled by the central nervous system and some hormones and so react not only to temperature change, but also to such things as excitement or the hot flush of the menopause.

ECZEMA – A red, scaly, itchy skin rash. Childhood forms usually start behind the knees and in the elbow creases.

ELASTIC CARTILAGE - Contains fibers of elastin as well as collagen (compare with fibrocartilage). It is strong but supple and forms the epiglottis, parts of the middle and outer ear, the Eustachian tube and parts of the larynx.

EMBRYO – The name given to the structure in the early stages of fetal development in the uterus (in the first trimester).

ENOCRINE GLAND – One of a number of ductless glands, scattered throughout the body, whose secretions pass directly into the bloodstream. The blood then transports the secretion to the organ they act upon. The endocrine glands (e.g. pituitary and thyroid glands) collectively form the endocrine or hormone system.

ENZYME - Any one of many substances produced by the body which act as catalysts in vital processes, such as digestion. They may either break down large molecules into smaller ones or utilize small molecules for growth, reproduction or defence against infection.

EPIDIDYMIS - A mass of tubes located at the back of each testicle. It is here that new sperm having been produced in the seminiferous tubules gain maturity and motility (ability to move). These sperm are stored in the epididymis until just before ejaculation, when they travel via the vas deferens to the prostate gland where the sperm will be mixed with secretions to form the semen or seminal fluid. This fluid is then pushed out through the urethra.

**EPIGLOTTIS** - A flap of tissue at the entrance to the larynx or airway. When food is being swallowed this flap is pushed across the opening so that the food cannot be pushed down into the lungs causing choking.

**ESOPHAGUS** - The gullet which leads from the mouth down through the chest to the stomach.

**ESTROGEN** - One of the two important female hormones. Variations in estrogen level occur during the monthly cycle and may explain many of the changes of mood which occur.

**EUSTACHIAN TUBE** - The tube that connects the middle ear (the part of the ear inside the ear drum) to the back of the throat. The tube allows the air pressure on both sides of the drum to equalize.

**EXCRETION** - The removal of liquid and solid waste materials from the body.

**EXOCRINE GLAND** - This type includes those glands which release their secretions to the surface of the body (e.g. sweat glands) or through the large ducts (e.g. the pancreas, which secretes substances into the small intestine).

**EXTENSOR MUSCLE** - A muscle whose purpose is to extend or straighten a body part, such as a limb. E.g. triceps in the upper arm. (Compare with flexor muscle).

**FALLOPIAN TUBES (OVIDUCTS)** - The two tubes arising out of the uterus and ending near the ovary. Eggs produced in the ovary normally pass through the fallopian tubes on their way to the uterus.

**FAT** - One of the three basic food types: fat is in fact the most concentrated provider of energy and is stored in the body in the adipose tissue.

**FECES** - The residue after the nutrient value of food has been absorbed by the small intestine. Water is absorbed in the colon and the feces (stools, motions) are passed out through the anus.

**FEMORAL ARTERY** - The artery supplying blood to the thigh.

**FEMUR** - The large bone of the upper leg which articulates at the hip in a ball and socket joint and extends to the hinge joint at the knee. Commonly called the 'thigh bone'. The femur is the longest and heaviest bone of the human body.

**FERTILIZATION** - The process where a sperm enters an egg and fuses with it to make the embryo that will implant itself and develop in the uterus.

**FETUS** - The name by which a developing being (in the uterus) is known, usually in the second and third trimesters. Before this it is an 'embryo'.

**FIBROCARILAGE** - Composed mainly of collagen fibers making it tough and able to withstand compression. It is most plentiful in the cushioning disks between the spinal vertebrae and it is also a tough form of connection between bones and ligaments.

**FIBULA** - This long very slender outer bone of the lower leg. Sometimes called the 'calf bone'. It is the more delicate and therefore more vulnerable of the two lower leg bones.

**FELEXOR MUSCLE** - A muscle whose purpose is to bend a body part, such as a limb. E.g. The biceps in the upper arm (compare with extensor muscle).

**FONTANAELLES** - The gaps between the developing bones of a baby's skull, covered by soft membranous tissue.

**FORAMEN MAGNUM** - The hole at the base of the skull through which an outlet is provided for the spinal cord.

**GALL BLADDER** - A sack-like organ attached to the liver which collects bile and then discharges it into the intestine in response to a fatty meal.

**GAMMA GLOBULIN** - The gamma globulins are proteins which circulate in the blood carrying antibodies. Gamma globulin injections may be given to combat infections.

**GANGLION** - A grouping of nerve cells. Also, a small cyst-like tumor, especially in the wrist or ankle.

**GENES** - The minute segments of chromosomes that determine inherited characteristics – such as eye color. Each characteristic is controlled by a pair of genes, one from each parent.

**GENETICS** – The study of inherited characteristics. This includes the study of diseases which can be passed on from generation to generation.

**GENITALS** – Part of the organs of reproduction (for example: the penis in the male; the clitoris in the female).

**GLAND** – Any organ which produces a secretion. The endocrine glands secrete into the bloodstream, while other glands have more local effects.

**GLUCOSE** – A simple sugar that is the main source of energy for the body's cells. It is extracted from starches and sweet foods.

**GLUTEUS MAXIMUM** – The large major muscle (as opposed to the smaller gluteus minimus) of the buttocks.

**GLYCOGEN** – A form of glucose which is stored in the liver and muscles and released as needed for energy.

**GONAD** – One of the primary sex glands, which produce sex hormones and reproductive cells. In males, the gonads are the testes where testosterone and sperm are produced: in females, the ovaries where estrogen and other hormones, as well as ova, or eggs are produced.

**HAMSTRING** – The group of muscles (semi-tendinosus, semi-membranosus and biceps femoris) at the back of the thigh. They straighten the leg at both the hip and the knee.

**HEMOGLOBIN** – The red oxygen-carrying pigment in red blood cells.

**HEPATIC** - Of or relating to the liver. For example, the hepatic artery delivers nutrients and oxygenated blood to the liver.

**HEREDITY** -The passing of genetic information from parents to children.

**HORMONES** - The chemical messengers of the body, hormones control the body's metabolic (chemical) processes. Carried in the blood.

**HYALINE CARTILAGE** - A bluish-white translucent tissue. It forms the skeleton of the embryo and allows growth to full adult height, after which it is reduced to a thin layer on the ends of bones. It is also found in the nose, the trachea and bronchi.

**HYMEN** - A thin, somewhat elastic and perforated membrane that partially covers the entrance to the vaginal canal. A traditional symbol of virginity, although its lack does not necessarily indicate intercourse has ever taken place.

**HYPERTROPHY** - The enlargement of a part of the body. E.g. the greatly enlarged voluntary muscles of body builders. Involuntary muscles can also enlarge; if this happens in the muscle of the heart, special treatment will be required to prevent heart failure.

**HYPOTHALAMUS** - The area at the base of the brain which controls many of the body's automatic and hormone-related activities.

**ILEUM** - The lower part of the small intestine and the last part food passes through before it reaches the cecum, or blind pouch where the large intestine begins. Its main purpose is to absorb food so that it can pass, digested, to the liver.

**ILIAC ARTERY** - The two large branches of the aorta (which divides approximately at midriff level) that supply blood to each of the lower extremities. It continues as the femoral and tibial arteries.

**IMMUNE SYSTEM** - The complex system by means of which the body defends itself against infection.

**INSULIN** - A hormone which is made in the pancreas and which lowers the level of sugar in the blood. Given by injection to treat diabetes, a condition in which too little insulin is produced.

**INTESTINES** - The long continuous tube connecting the stomach to the anus. The first part (the small intestine) absorbs nutrients, while the second (the large intestine or colon) processes the waste.

**JEJUNEM** - The part of the small intestine between the duodenum and the ileum. Its purpose is to allow passage of nutrients into the blood.

**JUGULAR VEINS** - Two veins draining blood from the head. An accidentally cut jugular can allow air into the circulation and can, therefore, be fatal.

**KERATIN** - The dead skin cells that make up the outer layers of the skin; it is shed in tiny scales. Hair and nails are a specialized form of keratin.

**KETONES** - Acid waste products from the burning of fats by the body's cells. Ketones are produced in uncontrolled diabetes, since cells have to use fat instead of sugar as fuel.

**KNEE JERK** - A reflex, where the knee muscles contract sharply to produce a kick as a result of being suddenly struck by a light blow with a tendon hammer.

**LACHRYMAL GLANDS** - Small glands which produce a fluid to lubricate and cleanse the eye. The fluid emerges from ducts, commonly called the 'tear ducts'.

**LARYNX** - The voice box, which contains the vocal cords.

**LENS** - The soft, elastic, transparent part of the eye just behind the iris. Its purpose is the fine focusing of light rays.

**LIGAMENT** - The strong fibrous cords which hold bones and joints together and also support the organs.

**LIVER** - The largest gland of the body; situated in the upper right hand corner of the abdomen just beneath the diaphragm; especially concerned with processing food for use by tissues.

**LUMBAR** - Of or relating to the group of vertebrae between the thoracic vertebrae and the sacrum. (E.g. lumbar puncture, in which fluid is drawn from between vertebrae in this region).

**LUNULA** - The white crescent found towards the base of the fingernail.

**LYMPHOCYTE** - One type of white blood cell found in the blood. Lymphocytes are also found in the lymph-vascular system where they control the body's immunity to disease.

**LYMPH - VASCULAR SYSTEM** – A secondary circulation system that carries fats to the cells, collects and filters fluid from the tissues through lymph nodes, and is a central feature in the activity of the body's immune system.

**MACROPHAGE** - A large white blood cell whose job it is to clear away debris (e.g. bits of bone) from healing wounds.

**MANDIBLE** - The hinged part of the skull, forming the lower jaw. Its purpose is to allow movement so that food can be crushed.

MAXILLA - The upper jaw in the skull.

MEDULLA OBLONGATA - Stem-like lowest part of the brain where it merges with the spinal cord. Here, things vital to life, such as heart rate control blood pressure maintenance, breathing and consciousness are controlled.

MELANIN - The pigment in the skin which gives skin its color. A sun tan is brought about by an increase in the amount of melanin in the skin.

MEMBRANE - Any thin sheet of tissue. The cells are surrounded by a wall or membrane whose chemical characteristics are central to the way they work.

MENARCHE - The time when menstruation starts.

MENINGES - The membranes which cover the brain (e.g. arachnoid, dura mater and pia mater) and the spinal cord. (Meningitis is an inflammation of the meninges).

MENOPAUSE - The cessation of menstruation known as the change of life.

MENSTRUATION - The period of time during which the uterus sheds its lining and some blood each month during a woman's reproductive years.

METABOLISM - The chemical processes by which the body works.

METACARPALS - Five bones radiating out from the wrist. These bones lead to the phalanges which form the thumb and fingers on each hand.

MIOSIS - A method of cell division in which chromosomes are duplicated, then they pair up and intertwine before pulling apart and dividing to produce sex cells containing half the information needed to produce a human being. The remaining half is supplied during fertilization.

MITOSIS - A process of cell division in which pairs of chromosomes separate. Each half then divides into two identical parts which arrange themselves so that when the respective parts move to opposite ends of the cell and the cell divides into two, each new cell will contain all the genetic information necessary to replace or duplicate existing body cells.

MITRAL VALVE - The valve on the left side of the heart which allows oxygenated blood to enter the left ventricle (from the left atrium). Its purpose is to prevent blood squirting back into the lungs when the left ventricle contracts.

MUCOS - The semi-liquid substance that coats many of the internal membranes, preventing both damage and infection.

MUSCLE - Powerful tissues which are responsible for all movement. Voluntary muscle functions under conscious control; involuntary muscle discharges its functions independently.

**MYELIN SHEATH** - The material which surrounds nerve fibers and which insulates and protects them.

**MYOFIBRIL** - A bundle of filaments within striated or voluntary muscle tissues. This bundle is made up of actin and myosin filaments, which consist of protein. Bundles of myofibrils are called 'muscle fibers'.

**NERVES** - Bundles of specialized conducting tissue which carry messages to and from the brain. Sometimes though a disease is said to be due to 'nerves' when it is thought that it is primarily due to an emotional disturbance rather than a physical one.

**NORADRENALIN** - A hormone produced by the adrenal medulla and which also makes up most of the chemical transmitter for sympathetic nerves. Among other things, it helps maintain even blood pressure.

**NUTRITION** - Nourishment. Adequate nutrition ensures that the body receives the correct amount and type of food for growth and the maintenance of health.

**OPTIC NERVE** - The nerve that runs from the retina – the light-sensitive membrane and carries messages to the brain.

**ORGASM** - The climax of sexual intercourse (involving emission of semen in the male).

**OSTEOBLAST** - A cell which produces bone.

**OVARY** - The female organ where the eggs are made. The ovaries are found inside the abdomen at the ends of the Fallopian tubes (although they are not connected) which carry the eggs down to the uterus.

**OVULATION** - The time at which the ovaries release an egg, usually in the middle of the menstrual cycle.

**OXYGEN** - The gas which makes up about a fifth of the atmosphere. Life depends upon oxygen to burn up fuel and produce the energy that drives the body's processes. The lungs are responsible for absorbing it from the air and transferring it to the blood.

**PALATE** - The rood of the mouth which is made up of the parts which separate the mouth from the nasal cavity. It consists of the hard palate and the soft palate.

**PANCREAS** - The organ at the back of the abdomen responsible for producing many of the digestive juices. It is also a hormone gland which produces insulin.

**PARASYMPATHETIC NERVOUS SYSTEM** - Part of the autonomic nervous system, controlled from the brain and the lower spinal cord, which interacts with the sympathetic nervous system (controlled from the spinal cord) to maintain a balance of the body's vital unconscious functions (e.g. breathing, digestion and heartbeat).

**PATELLA** - The slightly teardrop-shaped bone lying in front of and protecting the knee joint; commonly called the 'kneecap'.

**PELVIS** - The basin-like structure formed by the ring of bones at the base of the torso and into which the legs are hinged. It consists of the sacrum and coccyx; the ilium (hip bone), containing the acetabulum, into which the femur slots; the ischium (base of the buttock); and the pubis, made up of the two pubic bones, joined by the disk of cartilage known as the inter-pubic disk.

**PEPSIN** - A digestive enzyme, secreted by the mucous lining of the stomach, and whose purpose is to break down protein. It is the active constituent of the gastric juice, whose other part is hydrochloric acid.

**PERCEPTION** - Information about the outside world is received by the organs of sense (especially the eyes and ears) and collated to build up a picture of the world. This process is called perception.

**PERICARDIUM** - The fibrous membrane around the heart, which secretes a fluid for lubrication.

**PERIODONTAL LIGAMENTS** - The fibers which anchor the teeth in place. They are connected to the cementum under the gum and the alveolar bone (part of the jaw) in which the teeth roots are fixed. These ligaments are elastic and cushion shock to a degree when the teeth are biting.

**PERISTALSIS** - Wave-like rhythmic muscular contractions that cause food to be pushed along through the body during the digestive process.

**PERITONEUM** - The smooth transparent layer of tissue which lines the abdomen and encloses the abdominal organs.

**PINNA** - The external part of the ear whose purpose is to collect sound waves from the air and funnel them through into the ear canal.

**PIRIFORMIS** - The muscle which runs under the gluteus maximus and minimus to join the femur to the sacrum, thus enabling sideways movement of the thighs.

**PITUITARY** - A hormone gland, situated at the base of the brain, which controls the activity of many of the other glands in the body as well as secreting hormones controlling growth and water balance.

**PLACENTA** - The placenta is attached to the inside of the mother's uterus and through it the fetus receives all its food and oxygen via the umbilical cord. Commonly called 'afterbirth'.

**PLASMA** - the straw-colored liquid part of the blood, consisting mainly of water in which float among other things, red and white blood cells and platelets.

**PLATELETS** - The tiny cells in the blood which are essential for clotting.

**PLEURA** - The thin membrane which lines lungs and the inner thoracic cavity and eases friction during breathing ('Pleurisy' is inflammation of this pleural membrane).

**PONS** - The roughly ovoid-shaped mass of nerve fibers at the base of the brain and top end of the medulla oblongata. It is here that stimuli are relayed from the cerebral cortex to the opposite side of the cerebellum.

**PORTAL VEIN** - A large vein whose purpose is to deliver blood to an area other than the heart. E.g. the hepatic portal vein transports blood from the organs of the digestive system (and the spleen) to the liver for processing.

**POTASSIUM** - One of the most important of the body's minerals. The cells maintain a balance with potassium inside and sodium (salt) outside their walls.

**PROSTAGLANDIN** - A substance produced by the body which causes muscles to contract, causing an increased susceptibility to feel pain. Painkillers (analgesics) act by inhibiting the production of prostaglandins.

**PROSTATE GLAND** - The gland at the base of the bladder in males which is involved in semen production and which may enlarge later in life and obstruct urine flow.

**PROTEIN** - The substance which forms the basic building blocks of the body. Protein is made from strings of amino acid molecules.

**PUBERTY** - The stage during which the physical and emotional changes of sexual maturity take place.

**PULSE** - The force of the heart's contractions is felt as a pressure wave that travels along arterial walls. The term generally refers to the pulsations of the radial artery.

**RADIUS** - The long bone on the inside (at the wrist) of the lower arm, which articulates with the ulna at both wrist and elbow.

**REFLEX** - The nervous system has many automatic responses to various sorts of stimulation; these are called reflexes. For example, when a muscle is stretched on being hit by a tendon hammer it automatically contracts.

**REFLUX** - Where some fluid component of the body flows in the wrong direction. The reverse flow of acid from the stomach into the esophageal reflux.

**RETINA** - The multi-layered, light-sensitive are of the eye which lines the entire curved surface at the back of the eyeball. It is made up of two different light-sensitive cells, rods and cones, which together interpret images.

**SAC** - A pouch or soft-walled cavity (e.g. pericardial sac of the heart; alveoli, air sacs in the lungs; a sac caused by a cyst or tumor).

**SACRUM** - The triangular bone at the back of the pelvis, formed by five fused vertebrae. It is located immediately above the coccyx or tailbone, and below the five lumbar vertebrae of the spine.

**SALIVA** - The fluid present in the mouth and secreted by the salivary glands.

**SALT** - One of the body's basic requirements. The level of salt is critical in many of the body's chemical processes.

**SCLERA** - The tough outer layer of the eyeball beginning around the cornea (at the front). This layer constitutes what is commonly called the 'white of the eye'.

**SCROTUM** - The pouch which hangs outside the male body and is situated just behind the penis. It contains the testes.

**SEBACEOUS GLANDS** - Glands in the skin which make sebum to keep the skin soft and supple.

**SEBUM** - The grease produced by the sebaceous glands.

**SECRETIN** - A hormone produced in the duodenum when food is present and which causes the nearby pancreas to produce digestive enzymes.

**SECRETION** - Where a gland of any type produces (e.g. secretes) a substance (secretion) which works outside the gland itself.

**SEMEN** - The fluid which is discharged by the male when he ejaculates. Contains sperm and secretions from other glands such as the prostate.

**SEX HORMONES** - Hormones which control sexual functions. Testosterone is the main male hormone, while estrogen and progesterone are both important in female sexual functions.

**SINU-ATRIAL NODE** - Located in the right atrium, it passes impulses to both atria, causing them to contract. This is part of the process which maintains a normal heartbeat pattern. (See atrioventricular node and Bundle of His).

**SINUS** - Any of a number of cavities and/or channels for inflamed matter to pass through. Best known are the sinus cavities at the front of the skull, which help to cushion the impact of blows to the face. These sinuses also connect to the inside of the nose.

**SMOOTH MUSCLE** - That muscle concerned with involuntary movement of internal organs. E.g. peristaltic waves in digestion that push food along.

**SODIUM CHLORIDE** - Chemical name for common salt.

**SOLAR PLEXUS** - Not a medical term; used to describe a general area at the top of the abdomen.

**SPERM** - Fertilization of the female egg takes place when a sperm from the male fuses with it. Sperm are produced in the testes and emitted in the semen.

**SPHINCTER** - A muscular ring around any tube which serves to close it off.

**SPINAL CORD** - The cord of nervous tissue which runs down from the brain inside the central bony canal of the spine. All the nerves to the body below the neck branch off from the spinal cord.

**SPLEEN** - An organ in the upper left-hand corner of the abdomen. The spleen is responsible for filtering worn-out blood cells.

**STARCH** - The general term for carbohydrate foods which form the basis of the human diet.

**STERNUM** - The large piece of cartilage at the front of the rib cage and to which all but the 11th and 12<sup>th</sup> (the lowest) ribs are attached. Commonly called the 'breast bone'.

**STEROIDS** - Complex chemical molecules. The sex hormones and cortisone are steroids. Commonly the word is used to describe cortisone – produced by the adrenal glands – and the drugs which have a cortisone effect.

**SUBCLAVIAN ARTERY** - Each of the two branches of the artery which supplies blood to the arms. One branch comes from the arch of the aorta; the other from the innominate artery. It continues as the brachial artery, subdividing into the radial and ulnar arteries.

**SUBCUTANEOUS** - Simple means under the skin.

**SUGAR** - Chemically sugars are small carbohydrate molecules. Glucose is a sugar and it is the basic substance that the body's cells use for fuel.

**SYMPATHETIC NERVOUS SYSTEM** - The part of the autonomic nervous system controlled from the spinal cord, which interacts with the parasympathetic nervous system (controlled from the brain and lower spinal cord), to maintain a balance of the body's vital unconscious activities (e.g. breathing, digestion and heartbeat).

**TENDON** - The strong fibrous cords which bind muscles on to the bones and transmit the force of their contraction.

**TENOSYNOVITIS** - inflammation of the lubricated sheaths through which some tendons run. E.g. those running across the wrist.

**TESTIS** - The male sexual organ responsible for the production of both sperm and male sex hormone. The two testes hang at the base of the abdomen in the scrotum.

**TESTOSTERONE** - The male sex hormone, produced by the testes.

**THORAX** - The part of the body between the abdomen and the neck. The thoracic cavity (compared with abdomen and cranium) is supported by the rib cage and intercostal muscles. It contains the heart and lungs.

**THYMUS** - A small gland in the neck whose importance in controlling the body's immune system early in life has only recently been appreciated.

**THYROID** - The gland in the neck whose hormone (thyroxine) is very important in controlling the overall use of energy by the body.

**TIBIAL ARTERY** - The artery supplying blood to the lower leg. It is actually two-branched and a continuation of the femoral artery that divides in two approximately at the knee.

**TONSILS** - Two patches of lymphoid tissue which lie at the back of the throat on either side. May swell when infected.

**TRACHEA** - Commonly called the 'windpipe'. This tube or passageway connects the lungs to the throat and thus to the outside of the body.

**TRANSPLANT** - The transferring of any piece of living tissue from one location in the body to another. However, more usually used to refer to the transfer of organs from one individual to another.

**TRICEPS** - The large extensor muscle at the back of the upper arm. Together with the biceps, it facilitates elbow and shoulder movement (compared with biceps).

**ULNA** - The long bone of the lower arm, which is on the outside of the wrist where it meets the radius.

**UMBILICAL CORD** - The life-line between mother and fetus which carries all the nutrients and oxygen that the fetus needs.

**UMBILICUS** - The correct name for the depression (actually a scar) in the abdomen left by the umbilical cord which attached the fetus during its development to the mother. It is commonly called the 'navel', 'tummy button' or 'belly button'.

**UNCONSCIOUSNESS** - A state resembling sleep, from which people can't be aroused.

**URETER** - The tube which leads from each of the kidneys to the bladder.

**URETHRA** - The tube which leads from the bladder and through which urine is voided.

**URINE** - The product of the kidneys. Urine contains many of the waste products accumulated in the body.

**UTERUS** - The small pear-shaped organ located between the bladder and the rectum. It is connected to the ovaries by the Fallopian tubes. If conception takes place, the fetus will be

nurtured and develop within the uterus. If there is no pregnancy, the uterine lining (endometrium) will be shed during the monthly process of menstruation, together with a small amount of blood. The uterus is popularly called the 'womb'.

UVULA - The bit of the soft palate hanging at the back of the mouth. It has no obvious function but, it is thought it plays a role in the prevention of choking.

VAGINA - The female genital passage which leads to the uterus.

VAGINISMUS - Spasm of the muscles surrounding the vagina - can cause pain and difficulty on intercourse.

VALVE - A mechanism which only allows fluid to flow one way down a tube. The most important valves control blood flow in the heart.

VAS DEFERENS - The tube that carries sperm from the testes to the urethra. It is the vas which is cut in a vasectomy, thus stopping the sperm from continuing their passage.

VEIN - A blood vessel that carries blood back from the tissues to the heart.

VENA CAVA - The large vein by which blood returns to the heart from the body, via the inferior vena cava; and from the head, via the superior vena cava. The blood enters the right atrium of the heart.

VENTRICLE - One of two such pumping chambers of the heart, each of which receives blood from its corresponding atrium. The left ventricle pumps freshly oxygenated blood back into the body, via the aorta; the right ventricle pumps blood via the pulmonary artery, to the lungs where its oxygen will be renewed.

VITAMIN - An essential nutrient that the body requires only in small quantities. Vitamins are required in many of the body's chemical (metabolic) processes.

VITREOUS HUMOR - The jelly-like substance which fills the main interior chamber of the eye and which gives the eyeball its firm, rubbery texture.

VOLUNTARY MUSCLE - Also called 'striated'. Controlled from the brain, this form of muscle acts by contracting and is responsible for all forms of movement.

VULVA - The external female genital organs, including the area of the labia, the clitoris and the urethral opening. Uvulitis is an inflammation or infection of the vulva.

WERNICKE'S AREA - The area of the brain where sound is deciphered. (Compare with Broca's Area).

